THE MIDDLE AND UPPER DEVONIAN OF THE ROMNEY, WEST VIRGINIA, REGION[1]

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CONTENTS

INTRODUCTION

The name Romney shales, from "Romney in West Virginia," was published by N. H. Darton in 1892 "for the basal series of dark shales [in the Devonian]."[2] The formation was briefly described as follows:

> The basal members [of the Devonian] are fissile shales, in greater part black or dark brown in color, containing occasional thin beds of sandstone and limestone. Their average thickness is about 600 feet. . . . . The Devonian formations are not fossiliferous at many horizons in the region west of Staunton. In the Romney shales the following species are Corniferous [misprint for conspicuous]: *Discina lodensis*, *D. minuta*, *Orthis leucosia*, *Strophodonta demissa*, *Cyrtina hamiltonensis*, *Spirifera mucronatus*, *S. granulifera*, and *Leiorhynchus limitaris*. This is a Hamilton group fauna, but the stratigraphic range of Hamilton group equivalents in the Romney shales is not apparent, and Hamilton deposits probably extend some distance above.[3]

[1] Published by permission of Dr. William Bullock Clark, state geologist of Maryland.

[2] *American Geologist*, X (July, 1892), 17, and the name first appears in the table of formations on p. 13.

[3] *Ibid.*, pp. 17, 18.

The Staunton folio by Darton, which appeared in 1894, was the first one published by the United States Geological Survey for the Appalachian part of the Virginias. In this folio Darton gave the following description of the Romney shales:

> The rocks consist of dark shales, black and fissile below, but somewhat lighter and more compact above. Some of the basal beds are carbonaceous to a moderate degree, and they have been worked at several points with the mistaken idea that they might prove to be coal-bearing. The formation includes occasional calcareous streaks not far from its base, and the upper members contain alternations of thin, pale-brown or dark-buff sandy beds, which constitute beds of passage into the next succeeding formation. The vertical range and stratigraphic position of these passage-beds appear to be somewhat variable, so that there is no definite line of demarcation between the two formations.[1]

In both of these publications the Romney shales were limited below by the Monterey sandstone, which later has been shown to be the southern continuation of the Oriskany sandstone of New York,[2] as was stated many years earlier by Hall.[3] The upper limit of the Romney shales was the base of the Jennings formation, which has been shown to correspond with the Genesee shale, Portage formation (including the Sherburne, Ithaca, and Enfield members), and Chemung formation.[4]

While Chief of Division of Appalachian Geology of the Maryland Geological Survey the writer studied with some care the outcrops in the vicinity of Romney, Hampshire County, in northeastern West Virginia. Particular attention was given to the exposures of the Romney shales, while the subjacent and superjacent formations were also examined, and because Romney is the typical locality for this formation it is believed that a somewhat fuller account than has yet been published is desirable.

[1] *Geologic Atlas of the United States*, Folio 14, p. 2, col. 4.

[2] Schuchert, *Bulletin Geological Society of America*, XI (1900), 271, 312–15; Prosser, *Journal of Geology*, IX (1901), 416; Schuchert, *Proceedings United States National Museum*, XXVI (1903), 420; and Rowe, Schuchert, and Swartz, *Maryland Geological Survey, Lower Devonian*, text (1913), p. 90.

[3] Geological Survey of New York, *Palaeontology*, III (1859), 40, 401.

[4] Prosser, *Journal of Geology*, IX (1901), 419–21; Prosser, *Maryland Geological Survey, Middle and Upper Devonian*, text (1913), pp. 345–49; Swartz, *ibid.*, pp. 423–34.

DESCRIPTION OF WEST VIRGINIA SECTIONS

Cliffs near South Branch of the Potomac River.—The nearest outcrops of any considerable extent are the cliffs of argillaceous blue pencil shales by the side of the road southwest of Romney and near the bridge over the South Branch of the Potomac River. Most of these shales contain small iron-like concretions and on weathering are generally stained a brownish or iron color. There is a decided tendency in most of them to split into narrow, long, pencil-shaped pieces. The cliff in places is from 20 to 25 feet in height; the cut continues for some distance and affords a fine exposure of this part of the Romney shales. The dip is not great at this locality, and soon after crossing the river to the west the Oriskany sandstone is reached.

Fossils are rare, but a few occur in some of the layers. *Liorhynchus limitare* (Vanuxem), *Pterochaenia fragilis* (Hall), *Productella Ambocoelia*, a Crinoid stem, and perhaps a few other species occur. *Pterochaenia fragilis* (Hall) is known to occur in New York from the Marcellus shale to the Chemung formation inclusive, while *Liorhynchus limitare* (Vanuxem) is confined to the Marcellus shales and regarded as one of its most characteristic fossils. These bluish to blackish shales, containing the characteristic species—*Liorhynchus limitare* (Vanuxem)—of the Marcellus shale of New York, occur in at least the lower half of the Romney formation and are correlated with the Marcellus shale of New York.

Outcrops from Romney to Hanging Rock.—The valley road between Romney and Hanging Rock, which is down the river to the north of Romney, affords frequent opportunities to study the Romney formation, and the exposures may be considered as typical for its upper part.

Ledges of bluish-gray to grayish shale occur along the road by the side of Big Run, about one-half mile north of Romney, some of which has a decided concretionary tendency, forming large irregular layers. Fossils occur abundantly in certain of these layers, especially species of *Chonetes* and *Camarotoechia*, the latter on account of their abundance forming layers that are

partly calcareous. The following species were obtained at this locality:

Chonetes mucronatus Hall
Chonetes scitulus Hall
[The specimens are larger than the figures of this species, but in this respect do not differ from New York specimens in the Hamilton which are so referred.]
Chonetes lepidus Hall
Productella sp.
Camarotoechia congregata (?) (Conrad)
Camarotoechia sappho (?) Hall
Tropidoleptus carinatus (Conrad)
Cyrtina hamiltonensis Hall
Spirifer mucronatus (Conrad)
Spirifer granulosus (Conrad)
Ambocoelia umbonata (Conrad)
Vitulina pustulosa Hall
Grammysia sp.
Nucula corbuliformis (?) Hall
[External and internal impression.]
Nucula varicosa (?) Hall
Palaeoneilo constricta (Conrad)
Modiomorpha concentrica (Conrad)
Pleurotomaria (*Bembexia*) *sulcomarginata* Conrad
Macrochilus hamiltoniae Hall
Orthoceras sp.
Crinoid stems.

Dr. Kindle also stated that Hamilton fossils "may be collected near the railroad station at Romney."[1]

At the next rock-cut on the highway, about one mile north of Romney, the shales vary in color from bluish gray to gray and are rather more argillaceous than those of the preceding exposure. A number of small iron-like concretions occur in them, but fossils are not nearly so abundant as at the following locality and in some of these shales they are very rare. Toward the southern end of the bank they are more abundant and species of *Chonetes*, *Bellerophon*, *Orthoceras*, and some other forms occur. The complete list follows:

Chonetes mucronatus Hall
Chonetes scitulus Hall
Ambocoelia umbonata (Conrad)

[1] *United States Geological Survey, Bulletin 508*, p. 41.

Nucula bellistriata (Conrad)
Palaeoneilo constricta (Conrad)
Bellerophon sp.
Bellerophon (*Patellostium*) *patulus* (?) Hall
Loxonema hamiltoniae (?) Hall
Orthoceras sp.
Orthoceras constrictum (?) Vanuxem
Spyroceras crotalum (?) (Hall).

By the side of the highway about $2\frac{1}{4}$ miles north of Romney are outcrops of blue, arenaceous shale, the dip of which is very heavy, being nearly 80° east. These shales split into medium-sized pieces which do not disintegrate very rapidly into soil. The color is distinctly bluish and there are calcareous bands composed largely of fossils, *Spirifer mucronatus* (Conrad) being the most abundant species. Other Brachiopods are common, as *Tropidoleptus carinatus* (Conrad), *Chonetes*, etc., while there are also some small Lamellibranchs and Gastropods, but the species of these last two classes are rare. It is essentially a Brachiopod fauna of the Hamilton formation. The complete list of the species obtained at this locality is given below:

Stropheodonta (*Leptostrophia*) *perplana* (Conrad)
Chonetes mucronatus Hall
Chonetes scitulus (?) Hall
Chonetes setiger (Hall)
Chonetes lepidus Hall
Chonetes vicinus (Castelnau)
Productella sp.
Tropidoleptus carinatus (Conrad)
Cyrtina hamiltonensis Hall
Spirifer mucronatus (Conrad)
Vitulina pustulosa Hall
Grammysia lirata (?) Hall
Nucula randalli (?) Hall
Pterinea flabellum (?) (Conrad)
Aviculopecten sp.
Pleurotomaria (*Bembexia*) *sulcomarginata* Conrad
Loxonema hamiltoniae Hall
Tentaculites bellulus Hall
Orthoceras subulatum (?) Hall
Dalmanites (*Cryphaeus*) *boothi* (Green)
Crinoid segments.

This exposure is very similar to hundreds of outcrops in the arenaceous Brachiopod zones of the Hamilton shales in New York, and any geologist who has studied that formation in New York would at once recognize the great similarity in lithologic appearance. This, together with the presence of a Hamilton fauna, apparently justifies the writer in correlating that part of the Romney formation shown in the highway cuts north of Romney with the Hamilton formation of the standard New York section.

Hanging Rock.—About four miles north of Romney is a high cliff known as Hanging Rock, where the South Branch of the Potomac River has cut a deep and narrow gorge from the east to the west through Mill Creek Mountain. The river makes a big loop, and at the highway bridge south of Springfield it turns and cuts back through the ridge to its eastern side. At Hanging Rock, on the northern side of the river, is a high cliff in which the anticlinal arch of the fold in the Oriskany sandstone is finely shown. A fair idea of the appearance of this cliff may be gained from the halftone (Fig. 1.) At the western end of the gorge, by the side of the highway just after crossing the railroad track, is an excellent exposure of fine black to drab shales containing small concretions and some fossils. In one layer at least are numerous specimens of *Phacops cristata* Hall associated with *Dalmanella*, *Chonetes*, *Ambocoelia* and the representatives of a few other genera. The rocks are slightly arenaceous and break into small, somewhat elongated pieces on weathering. The layer in which the fossils occur abundantly is somewhat arenaceous and not very much above the top of the Oriskany sandstone. The species collected in this shale are given in the following list:

Stropheodonta sp.
Chonetes cf. *lepidus* Hall
[Two small imperfect internal impressions.]
Dalmanella lenticularis (Vanuxem)
Cyrtina hamiltonensis (?) Hall
[Small imperfect specimen.]
Ambocoelia umbonata (Conrad)
Styliolina fissurella (Hall)
[Abundant on some of the blocks.]
Phacops cristata Hall

In the above fauna, *Dalmanella lenticularis* (Vanuxem) is confined to the Onondaga formation; *Cyrtina hamiltonensis* Hall occurs in the Onondaga, Hamilton, and Portage; *Ambocoelia umbonata* (Conrad) from the Onondaga to the Chemung inclusive; *Styliolina fissurella* (Hall), southern Onondaga shale, Marcellus, Genesee, and Portage black shales; *Phacops cristata* Hall, Oriskany of Ontario, elsewhere the Onondaga. These species all

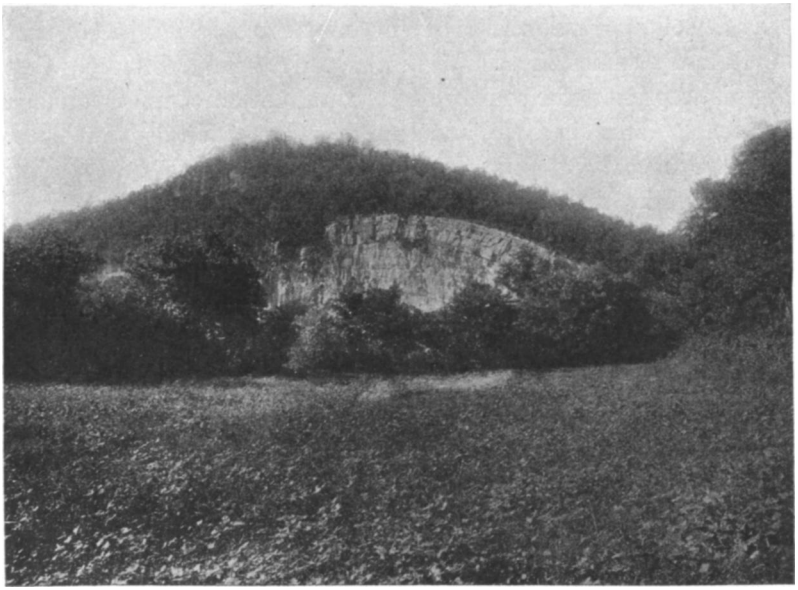

FIG. 1.—Hanging Rock, West Virginia, where the South Branch Potomac River has cut through Mill Creek Mountain. The rock cliff is Oriskany sandstone.

occur in the shales from Pennsylvania across Maryland and the Virginias which Dr. Kindle has correlated with the Onondaga of New York,[1] and since they came from the same stratigraphic horizon—the lower part of the Romney shale not far above the Oriskany sandstone—it appears that this part of the Romney ought to be correlated with the Onondaga. This correlation is in agreement with Dr. Kindle's statement that "the Onondaga shale

[1] *Journal of Geology*, XIX (1911), 97; *United States Geological Survey, Bulletin 508*, 1912; and *Maryland Geological Survey, Middle and Upper Devonian*, text (1913), pp. 48, 49, and 53–59.

member may be seen along the road through Mill Creek Mountain Gap, 1½ miles southwest of town [Romney]. Here the section shows an abrupt transition from the gray, highly calcareous coarse sandstone full of Oriskany fossils to drab shale approximately 100 feet thick, with some calcareous bands containing the Onondaga fauna. Fossils are not so readily found as at many other localities. Among those collected are *Anoplotheca acutiplicata*, *Dalmanella lenticularis*, and *Ambocoelia umbonata*."[1]

It is believed that the above account shows conclusively that the Romney shales in their typical locality near Romney, West Virginia, represent the southwestern continuation of the Onondaga limestone, Marcellus shale, and Hamilton formation of New York.

Outcrops south and north of Springfield.—North of Hanging Rock the valley road crosses a ridge of Oriskany sandstone and then for some distance south and north of Springfield the outcrops are mostly of thin black shales closely resembling lithologically the Marcellus shale member of the Romney formation. North of Springfield and perhaps three miles south of Green Spring in the cut of the Romney branch of the Baltimore and Ohio Railroad are black, argillaceous shales, and interstratified with the shales are several limestone layers, some of which are six inches in thickness. The limestone is very dark gray and blue to almost black in color, with a decided petroleum odor. It contains iron pyrites and is crossed by joints filled with calcite. There is a dip to the west and also to the south, and about 20 feet of rock is shown in the cut. Some of the layers of limestone contain a large number of small fossils, especially of the small species of *Ambocoelia*, which the writer has named *A. virginiana*.[2] Part of the limestone contains large numbers of this species, the best specimens of which came from this cut. When studied in the field these shales were referred to the Marcellus member; but it is possible that they occur lower in the Romney shale in that part of the formation which later has been correlated with the Onondaga.

Outcrops southeast of Romney.—To the east of Romney is the Jennings formation, succeeded by the Hampshire formation, the

[1] *United States Geological Survey, Bulletin 508*, p. 41.

[2] *Maryland Geological Survey, Middle and Upper Devonian*, text (1913), p. 202.

latter named from exposures in this county. There are only poor outcrops of the Jennings along the highway east of Romney, but farther east, in ascending the western slope of the northern part of South Branch Mountain, are excellent outcrops of red argillaceous shales belonging in the Hampshire formation. By the side of the highway, a short distance east of the first bridge over Big Run, are outcrops of sandstones and shales. The top and bottom layers consist of somewhat shattered, greenish to greenish-gray micaceous sandstone which breaks into blocks. Between the sandstones are thin, fissile, argillaceous shales, principally reddish-brown in color. The dip varies in different parts of the exposure from 11° to 14° S.E. No fossils were found, and the ledge is probably in the lower part of the Hampshire formation.

The rocks exposed by the side of the road east of this locality and up the valley of Big Run are mainly argillaceous shales, though there are some green ones, and interstratified with all of them are sandstones which are coarse-grained, greenish-gray in color, and massive. These outcrops occur along the highway below and in the vicinity of the locality known as the Peach Orchard, where, on top of the hill, the rocks are mainly red shale and the soil red in color, owing to their decomposition. These outcrops by the road and on the hill furnish a typical exposure of the Hampshire formation in northeastern West Virginia.

In Darton's account of the Devonian formations of central Virginia he says that "The Hampshire formation has yielded only a few plant remains which throw no light on the equivalency of the formation, but no doubt it comprised the representatives of the Catskill in their entirety or in greater part."[1] As stated by Darton, fossils are rare in this formation, as is the case in the corresponding one in Pennsylvania and New York; but the lithologic appearance and stratigraphic position agree, in general, with those of the Catskill formation, which has been shown to be a local one in New York, scarcely represented in the southwestern part of the state, while in the southeastern or Catskill Mountain region it has replaced all of the Chemung and the greater part of the Portage of western New York. It has been further shown that to the east of the

[1] *American Geologist*, X, 18.

Susquehannah River, in New York, the red rocks at first are interstratified with those which contain Chemung fossils, while farther east the red and greenish shales and sandstones replace all the rocks with the lithologic characters of the Chemung and its fauna disappears. Below the Chemung and in the midst of what corresponds to the Portage stage of western New York is another mass of red and greenish shales and sandstones called the Oneonta formation, which extends west to the Chenango Valley. In Delaware County the upper reds of the Oneonta and the lower of the Catskill unite and, in the Catskill Mountain region, extend downward into what is called the Sherburne sandstones, which represent the lower part of the Portage stage of western New York. In Pennsylvania, on following this mass of red rocks to the southwest it is found that they begin later, the change being gradual, and that the faunas of the Portage, including the Ithaca in Maryland and Chemung stages, reappear, as is the case in the southern part of western New York.[1]

The rocks exposed along the road following the highway toward Adams Mill, West Virginia, are largely red shales with some sandstones. Near the top of the hill are conglomerate layers, and across the upland the rocks are mostly red argillaceous shale, and all belong in the Hampshire formation.

In general it may be said that to the east of Romney the rocks belonging in the belt of the Jennings formation are mostly covered, while on the slope of the hill following the roads leading toward Frenchburg and Adams Mill are frequent outcrops of red shale interstratified with red sandstones belonging in the Hampshire formation. On top of these hills the red shales are most conspicuous, and decomposing rather readily into soil make good farming land.

Mill Creek southwest of Romney.—Mill Creek has cut a deep and narrow gorge through Mill Creek Mountain to the southwest of Romney which is followed by the highway from Romney to Moorefield Junction. In this gorge are high cliffs of the Oriskany sandstone which show excellently the massive nature of the formation.

[1] *Seventeenth Annual Report State Geologist* (New York), in which the writer has discussed this question.

The high cliff of Oriskany sandstone at the eastern end of the gorge is shown in Fig. 2. By the roadside not far west of the eastern end of Mill Creek Mountain Gap are layers of blue limestone interstratified with black argillaceous shales weathering to drab or brownish color. There are some fossils in the limestones, but they are infrequent. Along the road through this gap Dr. Kindle reported approximately 100 feet of drab shale with some calcareous bands succeeding the Oriskany sandstone, carrying an Onondaga

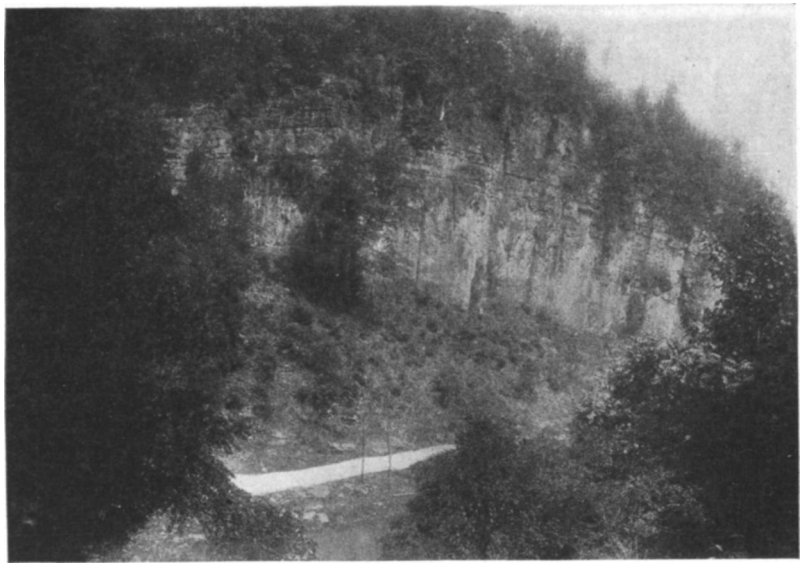

FIG. 2.—Eastern end of Mill Creek Mountain Gap, southwest of Romney, West Virginia. The steep cliff is composed of Oriskany sandstone.

fauna, and these basal shales of the Romney formation he correlated with the Onondaga of New York.[1]

Dr. Kindle further stated that: "The black shale representing the Marcellus is well exposed on the opposite side of the South Branch of Potomac River and appears to be barren. A little higher up the hill to the eastward on the west side of Romney the black fissile shale is succeeded by olive to gray slightly sandy shale with Hamilton fossils."[2]

[1] *United States Geological Survey, Bulletin 508*, p. 41.

[2] *Loc. cit.*

On the Mill Creek Road, $5\frac{3}{4}$ miles southwest of Romney or $1\frac{1}{4}$ miles east of Moorefield Junction, on the farm of Mr. Parker, is an outcrop of argillaceous shale. The dip is 35° N., 30° W. at this ledge, but in a short distance it changes. The shales are in general smooth, olive in tint, and in some that are a little mealy in texture are fossils, the most common species being *Pterochaenia fragilis* (Hall), *Buchiola retrostriata* (?) (v. Buch), *Goniatites*, *Coleolus*, etc.

This exposure is nearly all shale, and it belongs in the lower part of the Jennings formation. In fauna, lithologic appearance, and stratigraphic position it agrees closely with the Portage stage of the Upper Devonian of New York. It will be remembered that Dana united the Genesee, Portage, and Chemung to form his Chemung period, which corresponds very nearly, if not quite, to the Jennings formation.

On the bank of a run about one mile east of Moorefield Junction are olive, argillaceous shales by the side of the road, which alternate with thin, micaceous sandstones. No fossils were found, and the rocks are referred to the Portage stage. A dip of 45° S., 40° E. was noted. A ledge by the side of the road on the southern bank of Mill Creek, at the crossing directly east of Moorefield Junction is composed mostly of smooth, argillaceous, olive shales interstratified with thin sandstone layers which are rather micaceous. At the creek level is a sandstone layer two or more feet in thickness. The dip is about 2° west. No fossils were found and the rocks are referred to the Portage stage.

To the west of Moorefield Junction smooth, argillaceous, olive shales, alternating with layers of sandstone, occur along the highway and dip to the east. No fossils were found. These shales, as in the case of those east of Moorefield Junction, are considered as of Portage age and occur in the lower part of the Jennings formation.

Patterson Creek.—The next valley to the west of that of South Branch is that of Patterson Creek in Mineral County, and since in the volumes on the paleontology of New York certain Hamilton species are mentioned as occurring at Patterson's Creek, West Virginia, the outcrops in the lower part of the valley of this creek were examined. The Romney area of this valley is a continuation of the narrow band which lies between Collier and Nicholas moun-

tains, to the north of the Potomac River, in Allegany County, Maryland.

The railroad station and post-office now known as Patterson or Patterson Depot is the locality formerly known as Patterson Creek. There are no exposures in the immediate vicinity of the station, and the Baltimore and Ohio railroad track, along which are several cuts, was followed to the eastward. The first one east of the station shows massive Oriskany sandstone, the greater part of which is hard, light gray, and quartzitic, certain layers containing a considerable number of fossils, particularly specimens of *Spirifer arenosus* (Conrad), some of which are very perfect. At the eastern end of the cut the rocks dip sharply to the east, while farther to the west they are some distance above the track and nearly horizontal. In the second railroad cut east of the station is another outcrop of the Oriskany sandstone, which is also dipping to the eastward. In some of the partly decomposed layers of brown sandstone there are good specimens of *Spirifer murchisoni* Castelnau, associated with other Oriskany fossils. From near the center of the cut to the western end there is some of the very hard, quartzitic sandstone. The dip is about 23° S., 70° E.

At the first hill east of the cut described above are thin, bluish, arenaceous shales which form a low ridge. These shales are rather firm, and when crumbled the pieces are larger than those on the Williams Road to the north in Maryland. No fossils were found. These shales are apparently in the lower, fairly barren portion of the Hamilton member of the Romney formation. It is to be remembered in this connection that the lower part of the Hamilton formation consists of rather arenaceous shales, in which fossils are of infrequent occurrence. This area is the southwestern continuation of the belt of the Romney formation to the east of Collier Mountain in Allegany County, Maryland.

Along the hill by the highway about one mile south of Patterson Depot are outcrops of thin, bluish-black shales which are fairly argillaceous and split into thin pieces weathering to a brownish color. In certain layers fossils are rather thick, especially *Ambocoelia umbonata* (Conrad) and *Liorhynchus limitare* (Vanuxem). Specimens of *Coleolus* and small-winged Lamellibranchs were also

seen. On the ridge to the west is the Oriskany sandstone, dipping to the east, as shown in Rocky River and on the highway from the west perhaps one-sixth of a mile north of this locality. These shales contain the diagnostic species—*Liorhynchus limitare* (Vanuxem)—of the Marcellus shale and agree fairly well lithologically, as far as exposed, with those referred to the Marcellus shale in the Baltimore and Ohio railroad cut at the 21st Bridge, Maryland; consequently, they are referred to the Marcellus member of the Romney formation.

The valley to the east of this ridge along Patterson Creek is presumably composed of the Romney shale, which is probably in a small syncline. The steep wooded ridge to the east of Patterson Creek is the one in which occurs the first railroad cut east of Patterson Depot. The Patterson Creek Road was followed fully two miles from the station, and after the first exposure of the black Marcellus shales they are seen at frequent intervals at the roadside. The more southern shales examined, however, were rather coarser, somewhat more arenaceous, and less fossiliferous. The greater part of the Marcellus is slightly arenaceous and with less clay than is found in the exposures on the Williams Road to the northwest in Maryland, and the shales do not disintegrate so readily.

On Plum Run, two miles above Patterson Depot and below Mr. Robinson's house, are coarse, unfossiliferous, arenaceous shales varying to fairly thin-bedded sandstones of bluish-gray color. The zone, however, is clearly above the fine black shales of the Marcellus, which contain numerous specimens of *Liorhynchus limitare* (Vanuxem).

On Mr. Robinson's farm is a small stream to the southwest of Plum Run, on which are bluish shales and sandstones, some of the latter being very hard and slightly calcareous. It is probable that this sandstone zone corresponds with the lower one of the Hamilton member of the Romney formation on the Williams Road, Maryland. Specimens of *Spirifer mucronatus* (Conrad) and *Ambocoelia umbonata* (Conrad) occur sparingly. On the small hill to the south of the run are yellowish to greenish, very argillaceous shales, containing some fossils. *Chonetes* is abundant in certain thin layers while other species, occurring more sparingly, are *Spirifer mucro-*

natus (Conrad), *Spirifer audaculus* (Conrad), *Nuculites oblongatus* Conrad, *Phacops*, *Pleurotomaria itys* (?) Hall, *Orthoceras telamon* (?) Hall, and *Macrochilus hamiltoniae* Hall.

In color and composition these shales are fairly similar to those above the lower sandstone on the Williams Road, Maryland; but on weathering they seem to have hardened to some extent. This shale contains, here and there, numerous small hard concretions as well as those of clay-iron stone, and it is also blotched with spots and streaks of dark-red color from the weathering of the iron. It is very probable that the specimens of *Nuculites oblongatus* Conrad, *N. triqueter* Conrad, *Palaeoneilo constricta* (Conrad), *P. tenuistriata* Hall, *P. virginiana* Hall, *Grammysia alveata* (Conrad), *G. arcuata* (Conrad) listed by Hall from Patterson's Creek, Va.,[1] and perhaps other species, came from this portion of the Romney formation. These outcrops have a lithologic similarity to beds across the Potomac River in Maryland which have been correlated with the Hamilton and are their southern continuation. Furthermore, these rocks contain fossils that are common in typical outcrops of the New York Hamilton, and for these reasons they are referred to the Hamilton member of the Romney formation.

NOTE ON THE CORRELATION OF THE MARYLAND HELDERBERG FORMATION

Dr. Swartz in his "Introductory" account of "The Helderberg Formation" states that "Rowe divided the Helderberg into the equivalents of the Manlius, Coeymans, New Scotland, and Becraft formations of New York. O'Harra, who prepared a report upon the geology of Allegany County about the same time, assigned the same limits to it."[2] Mr. Richard B. Rowe was one of the writer's students when he was professor of geology in Union College, where Mr. Rowe studied under his direction the Helderberg formations in their typical region in the Helderberg Mountains of eastern New York. Later Mr. Rowe went as a graduate student to Johns Hopkins University and began the field study of the Paleozoic formations of western Maryland during the summer of 1897. In

[1] *Palaeontology*, Vol. V, Part I, Lamellibranchiata II, 1885.

[2] *Maryland Geological Survey*, *Lower Devonian*, text (1913), p. 97.

1898 the writer became Chief of Division of Appalachian Geology of the Maryland Geological Survey, and with Mr. Rowe as his principal assistant devoted that summer to field work on the Paleozoic formations of western Maryland. We worked together in the field and were fully agreed concerning the correlation of certain limestones with the Coeymans, New Scotland, and Becraft formations of New York, which is believed to be the first definite recognition of them in Maryland. A statement of the relationship of this work was published by the writer in 1901,[1] together with the correlation of the Helderberg limestone with the New York formations.[2] This was recognized by Mr. George W. Stose, who wrote as follows:

> The presence in this region [Pawpaw-Hancock Folio] of a representative of the Helderberg group of New York has long been known, but in earlier reports of the United States Geological Survey and of the Maryland Survey it was not differentiated as a separate formation but was included with the underlying calcareous formations under the name Lewistown. In 1901, Prosser, reporting the results of studies made by him and his associates for the Maryland Geological Survey, later embodied in the State report [Vol. VI (1906), 133, 134], recognized in the Maryland rocks the various faunal divisions of the Helderberg of New York.[3]

The writer in his *Historical Review and Bibliography* of the Maryland Devonian summarized the contents of his 1901 article on "The Paleozoic Formations of Allegany County, Maryland."[4] The notice of "The Geology of Allegany County" in the same review contains the statement that "The nomenclature and classification of the formations are those adopted by Messrs. Clark, Prosser, and Rowe for the Maryland formations."[5]

[1] *Journal of Geology*, IX, (1901) 409.

[2] *Ibid.*, 415, 416.

[3] *Geologic Atlas of the United States*, Folio No. 179 (1912), p. 9, col. 1.

[4] *Maryland Geological Survey, Lower Devonian*, text (1913), p. 51.

[5] *Loc. cit.*